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APPLICATION OF WIND DATA TO SITE AND BUILDING DESIGN:
A Partially Annotated Bibliography

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APPLICATION OF WIND DATA TO SITE AND BUILDING DESIGN: A PARTIALLY ANNOTATED BIBLIOGRAPHY

by

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Practically everything we do is directly affected by climate. The comfort we take for granted depends on climate or on techniques for overcoming it. Work and play efficiency are to a great extent determined by climatic conditions. But, useable microclimatic wind information is hard to come by--and so are procedures for applying and testing it through a site design process.

This bibliography is presented to provide students, educators, research workers and practicing designers in many fields with information sources on wind. It is primarily directed towards microclimatic information sources that could be applied to site planning or building envelope design problems, rather than macroclimate, wind as a destructive force, wind power, etc. A number of references pertain to comfort, which in most cases is the underlying reason for a concern for wind. A few of the numerous references on shelterbelts are also included, especially those that deal with the result of tests.

The sources listed herein were selected from English language literature on the topic identified through indexes, bibliographies in reviewed works, and the card file of the University of Illinois Library. The material presented in these sources reflects the interest of researchers and writers from a variety of fields including Architecture, Landscape Architecture, Agriculture, Ecology, Meteorology, Engineering and Urban Planning.

Part I of this bibliography is annotated and contains sources that appear to be the most useful from a design point of view; the brief annotations summarize the content with design and micro-wind in mind and in some instances present value judgments on usefulness. Part II includes references that may be useful but were not reviewed. This bibliography should not be considered all inclusive. Some sources have been omitted because of duplication, non-design content, and old-age. There are also, without a doubt, many sources still waiting to be discovered.

It is hoped that this bibliography may offer a good beginning for others interested in recognizing and working with one of our most powerful environmental forces, wind.

PART I

American Institute of Architects Bulletin. "Regional Climate Analysis and Design Data," The House Beautiful Climate Control Project, 1949-51.

Climatological charts and design data oriented to dwellings for the following areas: Mid-Ohio; South Florida-Miami; Arid Southwest; Gulf Coast; Chicago; Twin Cities; Washington, D.C.; Boston; Pittsburgh; Charleston, South Carolina; Albany, New York; Denver, Colorado; New York; St. Louis; and Portland, Oregon.

Architects Journal. "Climate and Topography," Vol. 148:752-763, No. 40, October 2, 1968; Vol. 148:817-830, No. 41, October 9, 1968.

Clearly presented, well illustrated text covering the physical basis of climate, local climates, influences on local climate, elements of the climate, weather maps, consequences of site selection, and definition of terms.

Architects Journal. "Air Movement and Natural Ventilation," Vol. 148:1284-1294, 1297-1298, No. 48, November 27, 1968; Vol. 148:1343, 1345-1364, No. 49, December 4, 1968; Vol. 148:1413-1430, No. 50, December 11, 1968.

An excellent, well illustrated, source for information on principles of air movement, wind flow over walls, wind flow over roofs, effect of a building on its environment, air movement in rooms, structural oscillations, chimney effluents, wind tunnels, wind velocities, typical wind patterns, and typical faults (design mistakes).

Architectural Forum. "Microclimatology: Facts for Architects, Relators and City Planners on Climatic Conditions at the Breathing Line," Vol. 86:114-119, March 1947.

A good but general discussion of microclimate. Well illustrated.

Architectural Record. "Designing Glass for Wind," Vol. 141: 163-166, February 1967.

Method to wind tunnel test windows for tall buildings.

Architectural Record. "Wind, Sun, Rain and the Exterior Wall," Vol. 142:205-216, September 1967.

Determining wind loads on tall buildings.

Armbrust, D. V., W. S. Chepil, and F. H. Siddoway. "Effects of Ridges on Erosion of Soil by Wind," Soil Science Society of American Proceedings, Vol. 28:557-560, July 1964.

A wind tunnel study using several heights of ridges and six wind velocities to determine the effects of the ridges on soil erosion, trapping of soil particles and wind velocity.

Aronin, Jeffrey. Climate and Architecture, New York: Reinhold Publishing Corp., 1953.

A well illustrated text devoted to explaining climatic elements and how to apply a knowledge of them to the orientation and design of buildings and towns.

Attaway, C. D. "How Cold is the Wind?" American Society of Safety Engineers Journal, Vol. 15:20-21, February 1970.

Wind chill.

Bagnold, Ralph A. The Physics of Blown Sand and Desert Dunes, London: Metheun, n.d.

All you ever wanted to know about the movement of blown sand over a nearly level surface.

Bates, D. W. "Building a Windbreak Fence," Hoard's Dairyman, Vol. 114:868, August 10, 1969.

Recommends a 20 percent porus fence, 10 feet high, for livestock windbreak, and gives details on construction.

Bergen, James D. "Cold Air Drainage on a Forested Mountain Slope," Journal of Applied Meteorology, Vol. 8:884-895, No. 6, December 1969.

Describes a study of nocturnal cold air flow on a small forested slope to relate volume and velocity of flow to net radiation balance of the slope.

Bernatzky, Aloys. "Climatic Influence of the Greens and City Planning," Anthos., Vol. 5:29-34, No. 1, 1966.

Argues for more "green" (especially trees) in urban areas to make microclimate more liveable. Very good example of the work one tree can do in the interest of climate, with specific data on carbon transformation, water, and oxygen production.

Blair, Thomas Arthur. *Weather Elements: A Text in Elementary Meteorology*, 5th ed., Englewood Cliffs, New Jersey: Prentice-Hall, 1965.

General text clearly presented on meteorology, observation, forecasting, world weather, etc.

Booth, Norman. "Microclimate Modification in Campus Design," Thesis, Department of Landscape Architecture, University of Illinois, Urbana, 1972.

Includes an illustrated discussion of the influence of landscape elements (including buildings) on wind, reducing potential stress of wind, utilizing potential value of wind and a case study application of information to a portion of the University of Illinois campus.

Bowne, Norman E., and John T. Ball. "Observational Comparison of Rural and Urban Boundary Layer Turbulence," *Journal of Applied Meteorology*, Vol. 9:862-873, No. 6, *December 1970*.

Results of a study comparing turbulent wind fluctuations between an urban setting and a typical rural one.

Brett, Lionel. *Architecture in a Crowded World*, New York: Schocken Books, 1971.

Nothing on wind. Points out the lack of concern architects have had for climatic information.

Brooks, Charles Ernest Pelham. *Climate in Everyday Life*, New York: Philosophical Library, Inc., 1951.

Attempts to answer some of the more common climate questions which might be asked by anyone choosing a site, planning a house, starting a business or any other activity in which prevailing weather conditions are an important factor. Part I is an account of climate from the point of view of a man living in it. In Part II, climate is regarded as an enemy to be faced. Part III describes ways of overcoming climate.

Bubel, Nancy. "A North Side Shelterbelt for our Birds," *Organic Gardening and Farming*, Vol. 17:86-87, November 1970.

Describes plants used in a residential windbreak.

Caborn, J. *Shelterbelts and Microclimate*, Edinburgh: H.M.S.O., 1957.

Extensive, detailed, well referenced coverage. Probably the most significant book on shelterbelts.

Caborn, J. Shelterbelts and Windbreaks, London: Faber & Faber, 1965.

Not as much technical information as previous Caborn publication; requires more reading to extract usable information.

Canaan, Gershon. Rebuilding the Land of Israel, New York: The Architectural Book Publishing Co., 1954.

The architecture of Israel with emphasis on how climate has been a determinant.

Caudill, William W. Toward Better School Design, New York: F. W. Dodge Corp., 1954.

Studies of classroom openings and orientation for air flow; how air behaves in classrooms. Many case studies presented.

Caudill, William W., and Bob H. Reed. Geometry of Classrooms as Related to Natural Lighting and Natural Ventilation, College Station: Texas Engineering Experiment Station, Research Report No. 36, July 1952.

A number of specific tests on classrooms-altering length, openings, heights, etc.

Caudill, William W., Sherman E. Crites, and Elmer G. Smith. Some General Considerations in the Natural Ventilation of Buildings, College Station: Texas Engineering Experiment Station, Research Report No. 22, February 1951.

Includes an illustrated discussion of how air moves, characteristics of air flow, analysis of several typical situations of air flow through buildings, planning considerations for natural ventilation, and presentation of a method for making accurate air flow predictions.

Cermak, J. E. "Environmental Problems Studied in Meteorological Wind Tunnels," Mechanical Engineering, 92:80-1, April 1970.

Article about research workers at Colorado State University testing scale models of cities in a wind tunnel to illustrate problems.

Chandler, T. J. "Climate and Building Design," Lighting Research and Technology, Vol. 2:220-224, No. 4, 1970.

General discussion about how climate needs to be considered more in design.

Chepil, W. S. "Vegetative and Nonvegetative Materials to Control Wind and Water Erosion," Soil Science Society of American Proceedings, Vol. 27:86-89, January 1963.

Evaluation of effectiveness and indication of cost per acre of gravel, resin emulsion, asphalt emultion, latex emulsion, straw and hay for surface wind erosion protection.

Conway, H. The Weather Handbook, Atlanta: Conway Publications, Inc., 1963.

Weather summaries for 100 U.S. cities and 100 cities around the world. Other charts and observations on everything except wind.

Cooper, Charles F. Ecological Effects of Weather Modification, Ann Arbor: University of Michigan, School of Natural Resources, Department of Resource Planning and Conservation, 1969.

General. Macro orientation. Wind not really considered.

Correa, Charles. "Climate Control," Architectural Design, Vol. 39:448-451, August 1969.

Five concepts for residential dwellings that each illustrate a design for a different climate.

Cron, F. W. "Snowdrift Control Through Highway Design," Public Roads, Vol. 34:227-34, December 1967.

Cross section design to prevent drifting.

Crossley, J. H. "The Wind: A Facet of Urban Environment," Thesis, Leeds School of Town Planning, 1971.

An interesting discussion covering air movement and its effect on comfort, general characteristics of air movement near the surface, effects of urban form on air movement, and general effects of a reduction of air speeds in urban areas. A good bibliography.

Dabberdt, Walter F. "Wind Disturbance by Vertical Cylinder in the Atmospheric Surface Layer," Journal of Applied Meteorology, Vol. 7:367-371, No. 3, June 1968.

Presents research on wind velocity distribution in the vicinity of a cylindrical obstacle, measured at two levels over a frozen lake surface.

"Dampers Blunt the Wind Pressure on Tall Buildings." Architectural Record, Vol. 150:155-158, September 1971.

Discusses the need for and the method of using dampers on World Trade Center.

Daubenmire, R. F. Plants and Environment, 2nd ed., New York: John Wiley & Sons, Inc., 1967.

Contains a general discussion of windbreaks and the effects of wind on plants.

Davenport, A. G. and W. A. Dalgliesh. "Commentary No. 1 Wind Loads," Supplement No. 4 National Building Code of Canada, pp. 543-551, 1970.

Outlines three ways to determine wind loads on buildings.

DeBray, B. G. "Wind Pressures on Multi-Storey Buildings," Engineering, Vol. 194:10-11, July 6, 1962.

Studies in wind tunnel of 24 story building model.

DeLaRue, E. Albert. Man and the Winds, London: Hutchinsons Scientific Publications, 1955.

General discussion including wind types, wind erosion, using wind for energy, physiological effects of wind, mythology and legends, benefits and drawbacks of wind, etc.

Dennis, C. E. and J. W. Carr. "Windbreaks for Ponds," Soil Conservation, Vol. 36:91, November 1970.

Describes a windbreak along a pond to reduce wave action and to provide swimming and ice skating protection.

Egli, Ernst. Climate and Town Districts, Consequences, and Demands, Zurich: Verlag fur Architektur, 1951.

Discusses the importance of wind, the influence of climate (and wind) on the development of historic places, and describes some desirable qualities for towns in each climate zone.

Erskine, Ralph. "Artic Primer," Landskap, No. 5:91-92, 1971.

English Summary. Discusses belief that architecture should reflect a specific solution to climatic problems of region rather than imitating temperate region design.

Evans, Benjamin H. Natural Air Flow Around Buildings, College Station: Texas Engineering Experiment Station, Research Report No. 59, 1957.

Good information on flow around and over buildings based on model studies in low-speed wind tunnel.

Ferber, A. E. "Windbreaks in '66 Blizzard," Soil Conservation, Vol. 32, 29-31, September 1966.

Evaluating the design and placement of windbreaks in the vicinity of roads and buildings.

Fitch, James M. "Buildings Designed for Climate Control," Weather and the Building Industry, National Research Council, Building Research Advisory Board, Building Research Conference Report No. 1:91-98, Washington, D.C., 1950.

Good article on how architects are not using climate information and some examples of application of climate information to design (mostly solar).

Fitch, James M. and Daniel P. Branch. "Primitive Architecture and Climate," Scientific American, Vol. 203:134-144, No. 6, December 1960.

A well illustrated article on primitive architecture and how it illustrates both an understanding of climate and of building materials.

Franklin, Thomas B. Climates in Miniature, London: Faber & Faber, 1955.

A non-technical home owner directed discussion of microclimate, covering soils, temperature, rain, frost, humidity and dew, wind, light, and shade, and home and farm microclimates.

Franz, M. "Effect of Wind on Plants," Organic Gardening and Farming, Vol. 9:44-47, July 1972.

General discussion on growth rate, mechanical effects, transpiration and evaporation.

Geiger, Rudolf. The Climate Near the Ground, Cambridge: Harvard University Press, 1966.

The bible of microclimatology. Very detailed information with an extensive bibliography.

Givoni, B. Man, Climate, and Architecture, New York: Elsevier Publishing Company, 1969.

Information packed reference covering the climate elements, elements of heat exchange between Man and his thermal environment, physiological and sensory responses to thermal stress, the biophysical effects of the environmental factors, the thermal indices, the thermophysical properties of building materials, the thermal effect of roof types and ceiling heights, wetness in buildings, solar radiation and its impact on buildings, orientation and its effect on indoor climate, thermal effect of windows and efficiency of shading devices, ventilation, principles of design and selection of materials to adapt buildings to climate--general considerations, and principles of design and selection of materials to adapt building to climate--application to specific climatic types.

Gloyne, R. W. "Some Characteristics of the Natural Wind and Their Modification by Natural and Artificial Obstructions," Scientific Horticulture, Vol. 17:7-19, 1964-65.

Good article covering wind speed at different heights, influence of ground contour on speed, and effects of natural and artificial obstructions on wind.

Golding, E. W. "Three Unconventional Sources of Energy," Engineering, Vol. 192:198-199, August 18, 1961.

General, on use of solar, wind, and geothermal energy for power.

Grillo, Paul Jacques. What is Design? Chicago: Paul Theobald, 1960.

Some examples of buildings and architectural elements designed with wind in mind. Discusses wind as an orientation force on buildings.

Hadlow, Leonard. Climate, Vegetation and Man, New York: Philosophical Library, Inc., 1953.

A general discussion in three parts of the influence of climate upon life on earth. Part I deals with principles that govern day and night, the seasons, and the world distribution of temperature, winds, rainfall, atmospheric pressure and ocean currents. Part II covers natural vegetation in relation to its climatic needs and Part III describes the major climatic regions of the world with emphasis upon the way climate governs the activities of man.

Halshausen, C. G. "Selective Bibliography of Physiological Studies and Problems of Building Design and Indoor Climate Control in Hot Humid and Hot Dry Environments," Architecture Science Review, Vol. 9:130-138, No. 4, December 1966.

Limited to tropical climate. Includes reference under the headings of building design and town planning design.

Hazlett, Thomas C. An Investigation of Microclimate Control, n.p., n.d.

A general discussion of climate elements, ways to control microclimate and the climatic personality of Illinois.

Heyne, D. J. "Earthen Windbreaks; Give Cattle a Break on the Open Plains," Soil Conservation, Vol. 34:114, December 1968.

Illustrates plans for one.

Holleman, Theo R. Air Flow Through Conventional Window Openings, College Station: Texas Engineering Experiment Station, Research Report No. 33, 1951.

Studies of air flow (graphic only-no data) through a variety of window openings.

House Beautiful. "Fourty Seven Ways to Lick A Tough Winter Climate," Vol. 95:152-159, No. 12, December 1953.

Describes a house in Vermont oriented with its back to the winter wind.

House Beautiful. "How to Harness the Breeze in Hot Humid Weather," Vol. 94:51-55, No. 7, July 1952.

A report of the Texas Engineering Experiment Station study on house ventilation.

Hoydysh, Walter G. "Aerodynamics: New Design Criteria," Architectural Forum, Vol. 137:58-61, No. 2, September 1972.

About problems that should require wind tunnel tests.

Jones, P. M., M.A.B. deLarrinaga, and C. B. Wilson. "An Urban Wind Velocity Profile," Atmospheric Environment, Vol. 5:89, No. 2, 1971.

Technical description of an urban wind profile between 100 feet and 1000 feet.

Jones, P. M., and C. B. Wilson. "Wind Flow in Urban Areas - Comparison of Full Scale and Model Flows," Building Science, Vol. 3:31-40, No. 1, August 1968.

Determining the accuracy of modeling.

Kaufman, Werner. "Stuttgart Cleans its Air," Landscape Architecture, Vol. 57:176-8, No. 3, April 1967.

An article about establishing and preserving green strips into the city (fresh air lanes) to allow air circulation.

Konzo, Seichi. Summer Air Conditioning, Chicago: Windsor Press, 1958.

An elementary reference on heating and cooling residences,

Landsberg, Helmut E. "Bioclimatology of Housing," Meteorological Monographs, Vol. 2, No. 8, October 1954.

The house is discussed as a modifier of external climate with some discussion of indoor comfort based on temperature, humidity and air motion.

Landsberg, Helmut E. "Man-Made Climatic Changes," Science, Vol. 170:1265-74, December 1970; Discussion, Vol. 173:461-2, July 1971.

Macro-changes that have taken place - largely due to urban development.

Landsberg, Helmut E. Physical Climatology, 2nd ed., DuBois, Pennsylvania: Gray Print Co., 1958.

A general reference which covers: collecting and using climatic data; climatological elements including wind; world, regional, local and spot climates; and applied climatology.

Landsberg, Helmut E. "Weather in the Streets," Landscape, Vol. 9:26-28, No. 1, Autumn 1959.

General discussion of climate and how it should be considered in urban design.

Landscape and Site Development. Ottawa: Design Branch, Department of Public Works, 1971.

Wind information limited to drifting snow caused by banks and hedges.

Lawrence, E. N. "Microclimatology and Town Planning," Weather, Vol. 9:227-32, No. 8, August 1954.

General discussion of the effects urbanization has on microclimate, and siting and design of buildings utilizing local climatological information.

Lee, Douglas Harry Kedgwin. Physiological Objectives in Hot Weather Housing, Washington, D.C.: Housing and Home Finance Agency, Office of International Housing, 1969.

Interesting publication covering hot dry and warm humid climates, and how to consider in housing design. (Design considerations, effect on man, considerations for specific rooms, etc.) Excellent bibliography.

Lofthouse, R.G.A. "Shelter Research," Agriculture, Vol. 75:174-80, April 1968.

General article pointing out the need for shelter belt research and the many questions that remain unanswered. Emphasis placed on protection for farm animals. Examples given of several shelterbelts in England.

Lot, Fernand. "Power From the Wind," Landscape, Vol. 9:25, No. 1, Autumn 1959.

Briefly describes the largest aeromotor in the world.

Lowry, William P. "The Climate of Cities," Scientific American, Vol. 217:15-23, No. 2, August 1967.

A general but interesting article illustrating the differences in the climate of a city from its environs.

Lynch, Kevin. Site Planning, 2nd ed., Cambridge: The M.I.T. Press, 1971.

Contains a brief and general discussion of air movement, buildings and air flow, and how to construct a crude wind tunnel.

Malena, Dave. "Protect Cattle with Earthen Windbreak," Successful Farming, Vol. 67:61, October 1969.

Using a mound for wind protection.

Malinowski, H. K., and F. H. Theakston. "Air Flow Patterns Around Farm Buildings," American Society of Agricultural Engineers, Transactions, Vol. 11:287-90, No. 2, March 1968.

Comparison of two wind tunnel tests with a water flume and full scale tests.

Manley, Gordon. "Climate and Landscape Architecture," Journal of the Institute of Landscape Architects, No. 74:4-7, May 1966.

General discussion suggesting landscape architects use climate information (especially sun/wind) when designing. Housing discussed generally.

Marchmant, Eric. "Sweeping Wind Off the Streets of a New Town Centre," Building Design, No. 16:14-15, June 1970.

Description of a study utilizing wind tunnel tests and resulting in recommendations for reducing the wind speed in the town centre of Cumbernauld New Town.

Maunder, W. J. The Value of the Weather, London: Methuen, 1970.

Economic effect of weather on agriculture, forestry, manufacturing, construction, transportation, utilities and commerce. Some general sociological and physiological aspects. Good bibliography.

Meroney, R. N. "Characteristics of Wind and Turbulence In and Above Model Forests," Journal of Applied Meteorology, Vol. 7:780-88, No. 5, October 1968.

A scale model forest, designed to simulate a real one, produced comparable data when subjected to wind tunnel tests. Velocity, turbulence, drag, and gaseous plume spread were measured.

Moysey, E. B., and F. B. McPherson. "Effect of Porosity on Performance on Windbreaks," American Society of Agricultural Engineers Transactions, Vol. 9:74-76, No. 1, 1966.

Effectiveness of fences with varying degrees of porosity.

Munn, Robert Edward. Descriptive Micrometeorology, New York: Academic Press, 1966.

Good clear reference covering wind flow around objects, winds in the forest, corrections to tower mounted anemometer data, wind flow in valleys, winds in a city, etc. Excellent bibliography.

Nelson, Bill. "The Vanishing Windmill," Hoards Dairyman, Vol. 116:452, April 1971.

A brief historical discussion about farm windmills.

Nelson, G. L., and H. Giese. "Wind Load Reactions in Open-Front Shelters," Agricultural Engineering, Vol. 43:142-149, March 1962.

Results of wind tunnel tests on farm shelters.

North Central Regional Workshop on Wind Erosion. Proceedings. Des Plaines, Illinois, 1969.

Series of articles on wind erosion problems in several midwestern states and reviews of wind erosion research.

Olgyay, Victor G. "Bioclimatic Approach to Agriculture," Housing and Building in Hot Humid and Hot Climates, National Research Council, Building Research Advisory Board, Conference Report No. 5:13-23, 1952.

A duplication of information in his book, "Design with Climate," except for a table on "non-thermal effects of air velocity."

Olgyay, Victor G. Design with Climate, Princeton: Princeton University Press, 1963.

An approach to the use of climatic information in design, illustrated in four climate regions. A good chapter on wind effects and air flow patterns. Lots of tables, charts and graphs which require considerable study to understand but an excellent reference for anyone interested in environmental design.

Olgyay, Victor G. "The Temperature House," Architectural Forum, Vol. 94:80-194, No. 3, March 1951.

Same material covered in his book, "Design with Climate."

O'Hare, Michael. "Designing with Wind Tunnels," Architectural Forum, Vol. 128:60-63, April 1968.

Good article explaining tests on a high rise and the conclusions on ways to alter wind flow.

O'Hare, Michael and Richard E. Kronauer. "Fence Designs to Keep Wind From Being a Nuisance," Architectural Record, Vol. 146: 151-156, July 1969.

Comparative data from wind tunnel tests on 10 fence designs.

Owen, P. R. "Buildings in the Wind," Quarterly Journal of the Royal Meteorological Society, Vol. 97:396-413, No. 414, October 1971.

A discussion of some of the problems arising from the flow of wind about buildings. These are illustrated in terms of the aerodynamics of vortex shedding and the interaction between a bluff body and turbulence in the approaching air stream.

Pope, A., and J. J. Harper. Low Speed Wind Tunnel Testing, New York: Wiley & Sons, 1966.

All about low speed wind tunnels including non-aeronautical uses.

Proceedings of the New Delhi Symposium. "Wind and Solar Energy," United Nations Education Scientific and Cultural Organization, Paris, 1956.

A series of papers on the utilization of, problems with, research on, and planning for, windpower, and the use of solar energy.

Progressive Architecture. "Wind Load on High Buildings of Unconventional Shape," Vol. 44:148-153, No. 3, March 1963.

Results of wind tunnel tests on model of Toronto City Hall.

Putnam, Palmer C. Power From the Wind, New York: D. van Nostrand Co., 1948.

Summary of problems faced in developing a 1250 kilowatt windmill and trying to utilize wind power.

Ramdas, L. A. "Natural and Artificial Modification of Microclimate," Weather, Vol. 12:237-240, No. 8, August 1957.

A brief and general discussion of a few methods to control or alter soil temperature, (change surface color, wet it, vegetative cover, etc.) and how plant communities modify microclimate.

Rapoport, Amos. House Form and Culture, Englewood, New Jersey: Prentice-Hall, Inc., 1969.

Interesting reading. Discusses form determinants of dwellings, including climate as a modifying factor. Wind receives good attention. Good bibliography. Well illustrated.

Read, R. A. "Tree Windbreaks for the Central Great Plains," U. S. Department of Agriculture Handbook No. 250, February 1964.

Everything you always wanted to know about tree windbreaks, including why you should plant, effects on wind velocity, how to select and arrange trees, and how to plant.

Rohles, F. H. "Psychologist Looks at Air Movement," ASHRAE Journal, Vol. 7:48-49, July 1965.

A study using monkeys to determine when wind velocities, coupled with varying temperatures, were pleasant or unpleasant.

Rosenberg, Norman J. "What Windbreaks Really Do," Crops & Soils, Vol. 18:16-17, June 1966.

General discussion of the effects windbreaks have on the surrounding microclimate.

Rubenstein, Harvey M. A Guide to Site and Environmental Planning, New York: John Wiley & Sons, Inc., 1969.

Usefulness limited to a method of illustrating weather bureau climatic information, and the best orientations for buildings in four general climate types.

Ruch, Paul. "Effects of Climate and Weather on Real Estate Values," Appraisal Journal, Vol. 22:531-549, October 1954.

General, with emphasis on crops.

Rudofsky, Bernard. Architecture Without Architects, New York: Doubleday and Company, Inc., 1964.

Wind reference limited to description of rooftop windscoops used in West Pakistan.

Rugg, Dean S. "Site and Climate," Spatial Foundations of Urbanism, Dubuque, Iowa: William C. Brown Co., pp. 92-98, 1972.

The general microclimate of cities.

Sharp, Robert P. "Wind-Driven Sand in Coachella Valley, California," Bulletin of the Geological Society of America, Vol. 75:785-803, September 1964.

Results of an 11-year study to determine patterns and effect of wind blown sand on man-made objects.

Siddoway, F. H. "Barriers for Wind Erosion Control and Water Conservation," Journal of Soil and Water Conservation, Vol. 25:180-184, September 1970.

A case for using vegetative barriers to help control wind erosion and trap snow for water conservation.

Silverberg, Robert. The Challenge of Climate: Man and His Environment, New York: Meredith Press, 1969.

General history of climate; how man evolved through the end of the ice age; how climate may effect efficiency and production.

Siple, Paul A. "Climatic Criteria for Building Construction," Weather and the Building Industry, National Research Council, Building Research Advisory Board, Research Conference Report No. 1, Washington, D.C., 1950.

A review of the House Beautiful-AIA climate control project. What they did and why.

Skidmore, E. L. "Assessing Wind Erosion Forces: Directions and Relative Magnitudes," Soil Science Society of America. Proceedings, Vol. 29:587-590, September 1965.

Method for computing wind erosion force vectors which were then used to compute proper orientation for maximum protection wind barriers.

Skidmore, E. L., N. L. Nossaman, and N. P. Woodruff. "Wind Erosion as Influenced by Row Spacing, Row Direction, and Grain Sorghym Population," Soil Science Society of America. Proceedings, Vol. 30:505-509, July 1966.

A determination that wind erosion in a sorghym grain plot is less with narrow row spacing, high plant population, and rows perpendicular to wind direction.

Soil Conservation. "Windbreaks," Vol. 35:49-71, October 1964.

The entire issue devoted to windbreaks. General information on how often used, general savings, etc., but no technical information.

Stoeckeler, J. H. "Design of Shelterbelts," World Crops, Vol. 16:20-23, December 1964.

A well referenced article on the various beneficial effects shelterbelts provide.

Sturrock, J. W. "Evaluation of Plastic Windbreak and Glasshouse Shading in Canterbury, New Zealand," New Zealand Journal of Agricultural Research, Vol. 12:248-255, February 1969.

Results of field tests on plastic netting using various layouts and degrees of permeability.

Successful Farming. "Slotted Windbreaks Stop Winter Drafts," Vol. 68:1313, No. 5, March 1970.

Explains that for maximum effectiveness windbreaks should allow some air to pass through and under.

Sutton, Grahm. "Micrometeorology," Scientific American, Vol. 211: 62-70; 75-76, No. 4, October 1964.

A general illustrated discussion of what micrometeorology is and how it should prove useful in such areas of concern as pollution and food production and research.

Swank, Gerald W., and Robert W. Booth. "Snow Fencing to Redistribute Snow Accumulation," Journal of Soil and Water Conservation, Vol. 25:197-198, September 1970.

A field study of a series of snow fences to redistribute snow supplies in an area where snow is frequently relocated by strong winds.

Theakston, F. H. "Control Wind and Snow Around Buildings," Hoard's Dairyman, Vol. 108:707, June 25, 1963.

Useful and clearly illustrated suggestions on arrangement and orientation of farm buildings to reduce drifting and control wind flow.

Theakston, F. H. "Control Wind Patterns Around Buildings," Hoard's Dairyman, Vol. 114:1187, October 25, 1969.

A few suggestions on things that can be done in and around farm buildings to reduce wind velocity and prevent structural damage.

Theakston, F. H. "Snow Accumulation About Farm Structures," Agricultural Engineering, Vol. 43:139-141, March 1962.

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